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SML-110
Switch Machine Lock

US&S Part No.
N47302301
N47302302

PN-150SSR
Solid-State Relay

US&S Part No.
N40103601

- ♦ Description
- ♦ Installation
- ♦ Operation
- ♦ Maintenance

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Revision History

Rev.	Date	Nature of Revision
Original	October 2001	Original Issue
1	January 2008	Incorporate ECO 140292-1: changed 23 amps output current to 24 amps throughout text and in Figure 1-4; removed wiring in center view of parts location diagram (Figure 10-2). Included new installation views in Section 3 and reworked text. Included parts lists and associated parts location diagrams in Section 10.

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1 Introduction

1.1 Introduction

This service manual provides descriptive information, specifications, and instructions on the installation, operation, and field maintenance of Switch Machine Lock SML-110 (N47302301 and N47302302) and Solid-State Relay PN-150SSR (N40103601) that permit High-Voltage Solid-State Switch Machine Control.

1.2 General Application – SML-110 and PN-150SSR

The SML-110 Switch Machine Lock and the PN-150SSR Solid-State Relay replace the vital relays normally used to control switch machines. They can be installed at processor-based or conventional vital relay interlockings.

The SML-110 unit can sustain a short circuit on its output terminals without suffering any damage. Overload protection is provided with a built-in timer. The timer will shut off the SML-110 output after 18 seconds if switch correspondence is not achieved. Correspondence normally occurs well before 18 seconds and, at that time, the switch machine contacts interrupt the motor current. The output terminals are electrically isolated from the 120 VAC input terminals, eliminating the need for a separate 60 Hz isolation transformer.

If preferred, traditional overload protection methods can also be used. A processor-based interlocking controller can be programmed to shut off the SML-110 after a predetermined amount of time. For a relay-based interlocking application, an overload relay can be used.

A single switch requires one SML-110 unit and one PN-150SSR Solid-State Relay. In the case of a double crossover, the same SML-110 unit can be used for all of the machines at the location. One PN-150SSR Solid-State Relay is required for each switch. One SML-110 can operate two switch machines simultaneously.

See Figure 1-1 for a block diagram of the SML-110 coupled with the PN-150SSR.

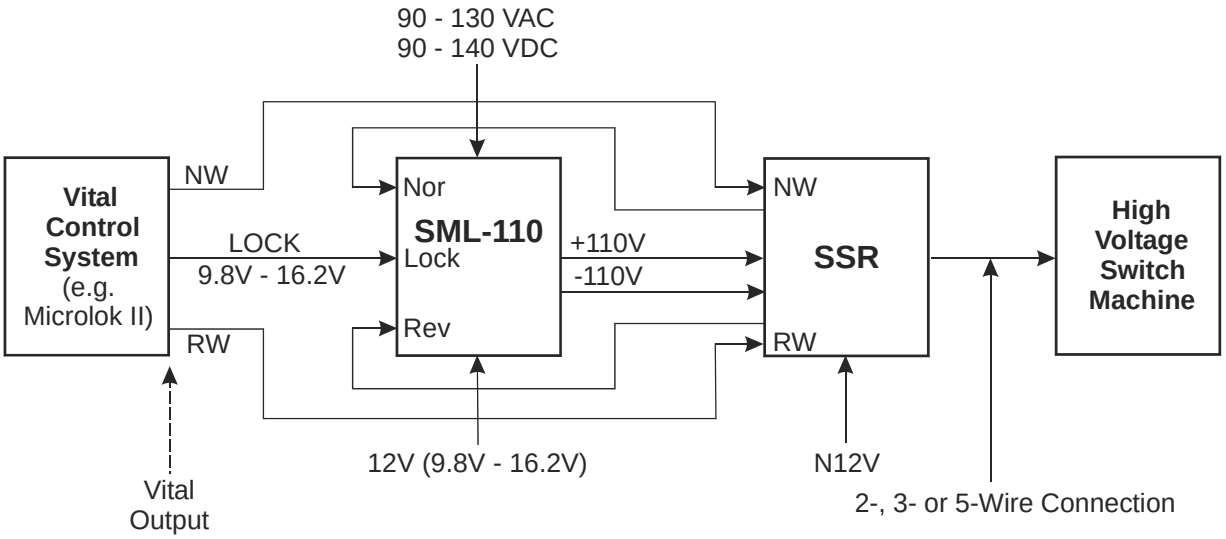

Figure 1-1 - SML-110 and PN-150SSR

Figure 1-2 and Figure 1-3 illustrate typical application circuits that show SML-110 control of two 110 VDC switch machines.

Electronic Switch Machine Control Wiring Diagram
Showing Control of Two 110 VDC Switch Machines

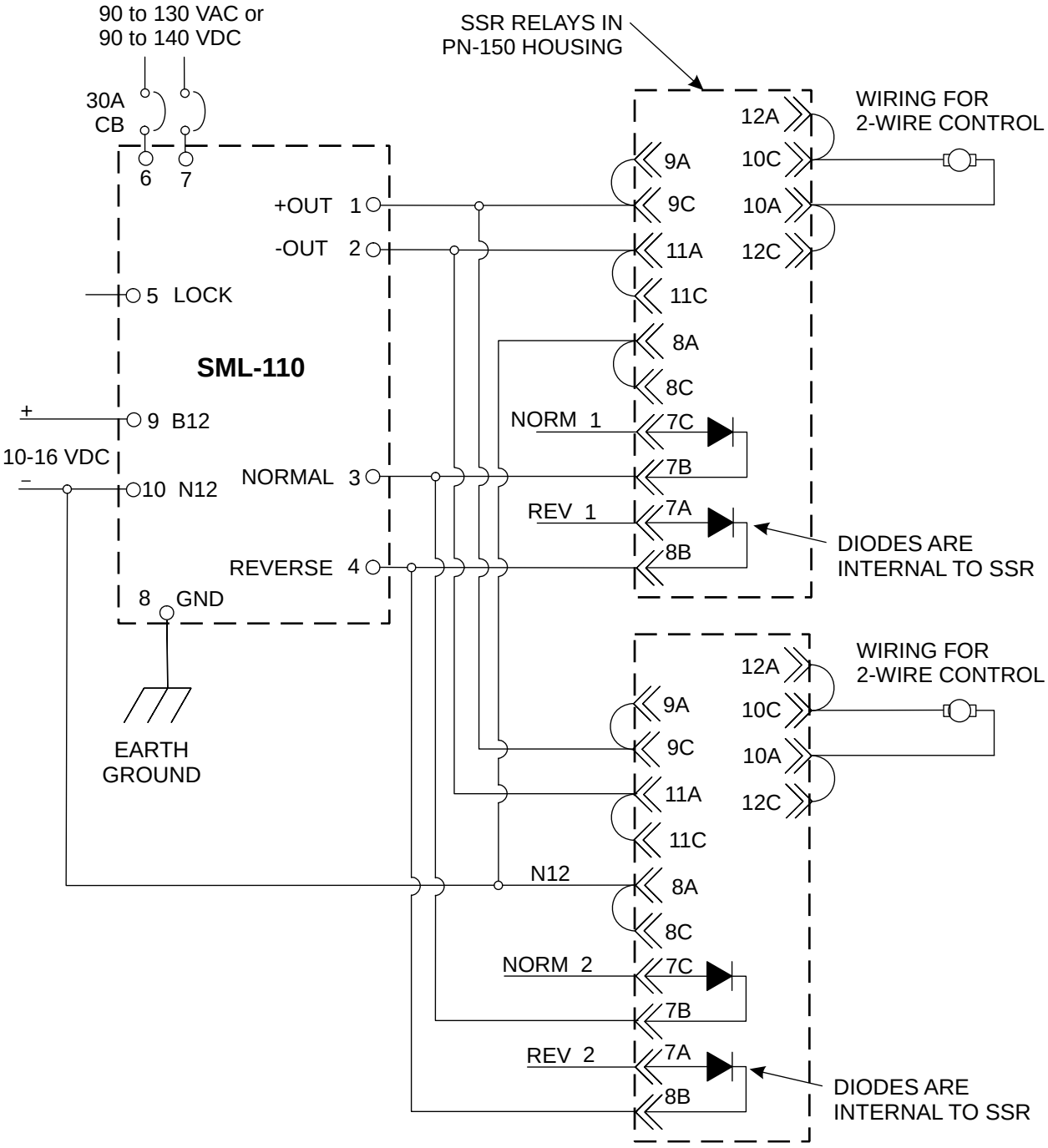

Figure 1-2 - SML-110 Control of Two Switch Machines (2 Wire)

Electronic Switch Machine Control Wiring Diagram
Showing Control of Two 110 VDC Switch Machines

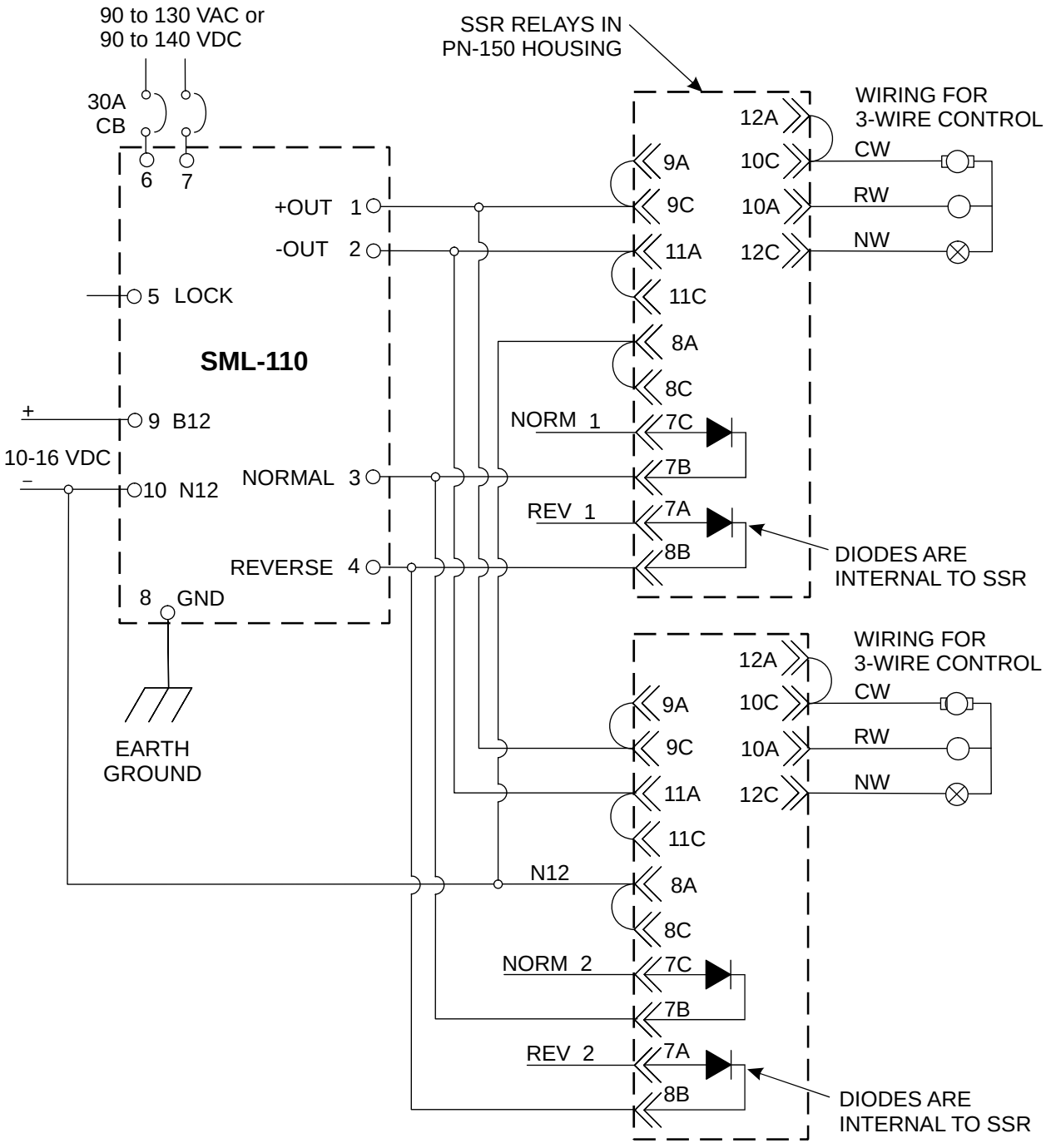

Figure 1-3 - SML-110 Control of Two Switch Machines (3 Wire)

1.3 Specifications

1.3.1 SML-110 Switch Machine Lock

Specifications for the SML-110 Switch Machine Lock are shown in Table 1-1.

Table 1-1 - Specifications for SML-110 Switch Machine Lock

Parameter	Value
Input Voltage	(90 VAC to 130 VAC) **or** (90 VDC to 140 VDC)
Output Voltage/Current	120 VDC @ 20 amps
Dielectric Withstanding Voltage	2,000 Vrms
Short Circuit Protection	Built-in; set to 24 amps
Max. Wiring Distance from SML to Switch	500 ft. using 1,000 ft. of #12 wire at 1.6 ohms/ 1,000 ft. producing a 24 Volt drop at 15 amps (1,000 ft. using 2,000 ft. of #9 wire) (2,000 ft. using 4,000 ft. of #6 wire)
110 V Supply and 110 V Output Wiring	#12 TC blue or equivalent
Internal Shut-Off Timer	14 to 20 seconds
Operating Temperature	-40 to +70 °C

1.3.2 PN-150SSR Solid-State Relay

Specifications for the PN-150SSR Solid-State Relay are shown in Table 1-2.

Table 1-2 - Specifications for PN-150SSR Solid State Relay

Parameter	Value
Input Control Voltage	9.8 to 16.2 VDC
Output Voltage/Current	24 amps at 120 VDC
Operating Temperature	-40 to +70 °C

1.4 SML-110 Output Characteristics

Figure 1-4 shows the value of the output voltage with a battery voltage of 120 VDC as the load is increased to the 24 amp current limit. When operating the SML-110 from AC power (120 VAC), the DC output voltage will be similar, but will also contain 120 Hz ripple.

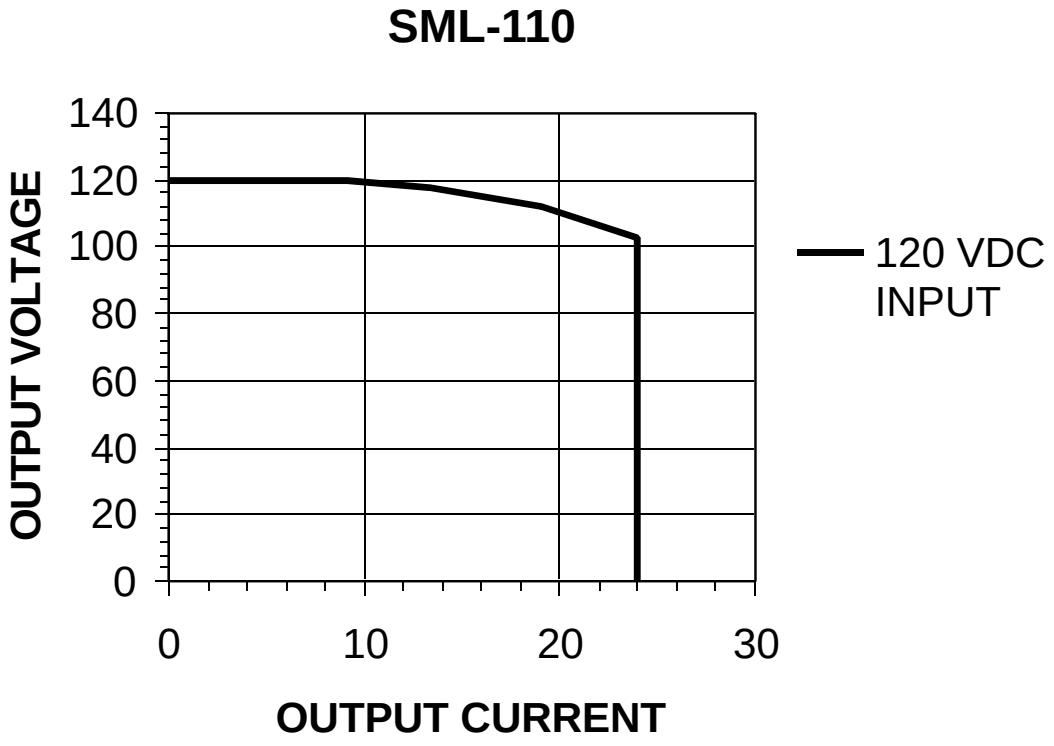

Figure 1-4 - SML-110 Output Characteristics

1.5 Conventions in Manual

1.5.1 Abbreviations, Acronyms, and Symbols

amp(s)	amperes
DC	direct current
LED	light-emitting diode
LR/LSR	lock relay/lock stick relay
NW	normal request
RW	reverse request
US&S	Union Switch & Signal
VAC	volts alternating current
VDC	volts direct current
Vrms	volts root-mean-square
Ω	resistance in ohms

1.5.2 Definitions

CAUTION Caution statements indicate conditions that could cause damage to equipment.

WARNING Warning statements indicate conditions that could cause physical harm, serious injury, or loss of life.

1.6 Safety

Read and thoroughly understand this manual before attempting any of the procedures listed. Pay particular attention to the **WARNING** and **CAUTION** statements that appear throughout this manual. Always observe standard precautions familiar to trained electrical technicians. Always adhere to all safety regulations stipulated by the railroad.

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2 Equipment Description

2.1 SML-110 Switch Machine Lock

The SML-110 Switch Machine Lock is a vital conditional power supply that provides power to a switch machine motor. It delivers a nominal 120 VDC output with a limited current of 24 amps from an ac or dc source when activated by a nominal 12 VDC input. This output is sufficient to simultaneously drive two switch machines. To deliver an output voltage, the SML-110 requires the presence of two out of three inputs: switch machine lock and either the normal or reverse position request. These inputs can be relay contact closures or outputs from an interlocking processor. The output voltage of the SML-110 Switch Machine Lock is fed as an input to the PN-150SSR Solid-State Relay.

A thermal switch protects the unit from overheating by shutting it down until the temperature is reduced to an acceptable level, at which time the switch resets itself. The Power LED on the front of the unit indicates when the output voltage is present. A short circuit on the SML output will cause the LED to turn off.

2.2 PN-150SSR Solid-State Relay

The PN-150SSR Solid-State Relay consists of two dual solid-state relays housed inside a US&S PN-150 Relay Case. These relays route the correct polarity voltage required to operate the switch machine to either the normal or reverse position. In addition to the voltage from the SML-110, the PN-150SSR Solid-State Relay requires a second input, which is either the normal or reverse position request. The input can originate from relay contacts or a vital interlocking processor.

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3 Installation

3.1 Hardware

The SML-110 is in a sheet metal housing for installation on standard equipment rack relay mounting bars. Typically, the unit is mounted with a combination rack mounting plate/AAR terminal board that provides AAR terminals for external wiring. A 12-pin male connector on the rear of the unit permits plug connection of the SML unit to the rack mounting plate.

Major subassemblies in the SML-110 are mounted on a chassis shelf, or are attached to the underside of the aluminum heat sink. Components are accessed by removing a one-piece, wrap-around shell on the housing. A single LED on the front panel of the unit indicates the presence of output power to drive the switch machine.

The PN-150SSR consists of two dual solid-state relays in a PN-150 relay case used to make connections to the switch machine for motor direction control. Each of the solid-state relays provides the equivalent of two Form A (normally open) contacts. Functionally, the solid-state relay modules consist of two independent SCRs optically isolated from the control. One of the solid-state relay modules makes motor connections to drive the machine to the normal position. The other relay module makes motor connections to drive the machine to the reverse position. The SCRs are rated at 480 V and 40 amperes. Two LEDs indicate which relay is energized, normal or reverse.

3.2 Equipment Rack Mounting and Wiring

3.2.1 SML-110 Installation

WARNING

Make certain all operating power sources to the SML-110 and PN-150SSR are turned off before connecting any wires to the units. Otherwise, personal injury and/or equipment damage may result.

The SML-110 is in a standard equipment rack that uses relay mounting bars. The SML-110 has a separate mounting plate/AAR terminal board to allow plug-in installation on and removal from the mounting plate. The units may be mounted adjacent to the controlling vital system without creating "noise" problems in logic or I/O wiring. Neither unit requires positive ventilation. However, the SML-110 should be positioned on the rack to allow a minimum of 1/4 inch of open air space around the heatsink.

All wiring to the SML-110 terminates on standard AAR terminal posts. Wiring to the PN-150SSR terminates on standard relay contact springs pushed into a relay mounting base. The SML-110 Switch

Lock occupies three US&S PN-150B relay spaces and nests with other relays. The PN-150SSR solid-state relay mounts in one PN-150B relay space.

NOTE

The standard base (N4513760302) for the PN-150SSR relay includes 20 contact receptacle springs for 14-16 gauge wire. When the PN-150SSR must handle high voltage/current for certain switch machines, another relay base (N4513760305) is used. This base includes contact receptacle springs for number 10 wire.

See Figure 3-1 for views and dimensions of the SML-110, and see Figure 3-2 for views and dimensions of the PN-150SSR.

3.2.2 Surge Protection for SML-110

Surge protection can be provided for the Normal, Reverse, and Lock inputs of the SML-110 by installing 5KP16A TransZorbs™ between terminals on the SML-110, as shown in Figure 3-3. This method of protection should be used when the SML is located remotely out of the wayside case at the switch machine.

3.2.3 150SSR Relay Installation

The 150SSR relay plugs into the standard base that should already be installed. The relay is factory equipped with indexing pins to prevent insertion of incorrect relays into a mounting base. The relay has an indexing plate that is applied to the mounting base at the time of initial installation.

The following data defines the indexing that has been established for the 150SSR relay.

a. As the chart below shows, the index code always consists of four digits (such as 0001, 0002, or 0101). It is used for both the relay and the indexing plate on the mounting base.

Location of Indexing Pins			
ROW			
A	B	C	D
4	0	3	6

b. The index code for each mounting base is determined by the placement of the holes in the numbered vertical rows of the large white nylon indexing plate that is affixed to the front of the mounting base.

WARNING

Never drill new holes in a base indexing plate, which will permit the application of relays with different part numbers. Never change the indexing pins on the back of a relay unless it is being converted to a new part number. Such tampering may compromise the safe functioning of the circuit in which the relay is used.

NOTE

Never remove the indexing plate from the mounting base, unless it is damaged or the indexing is to be purposely changed to accommodate a relay of a different part number. Discard the indexing plate that comes in a bag tied to the handle of all new relays, unless it is needed for replacement of a damaged indexing plate, or for application to a new mounting base.

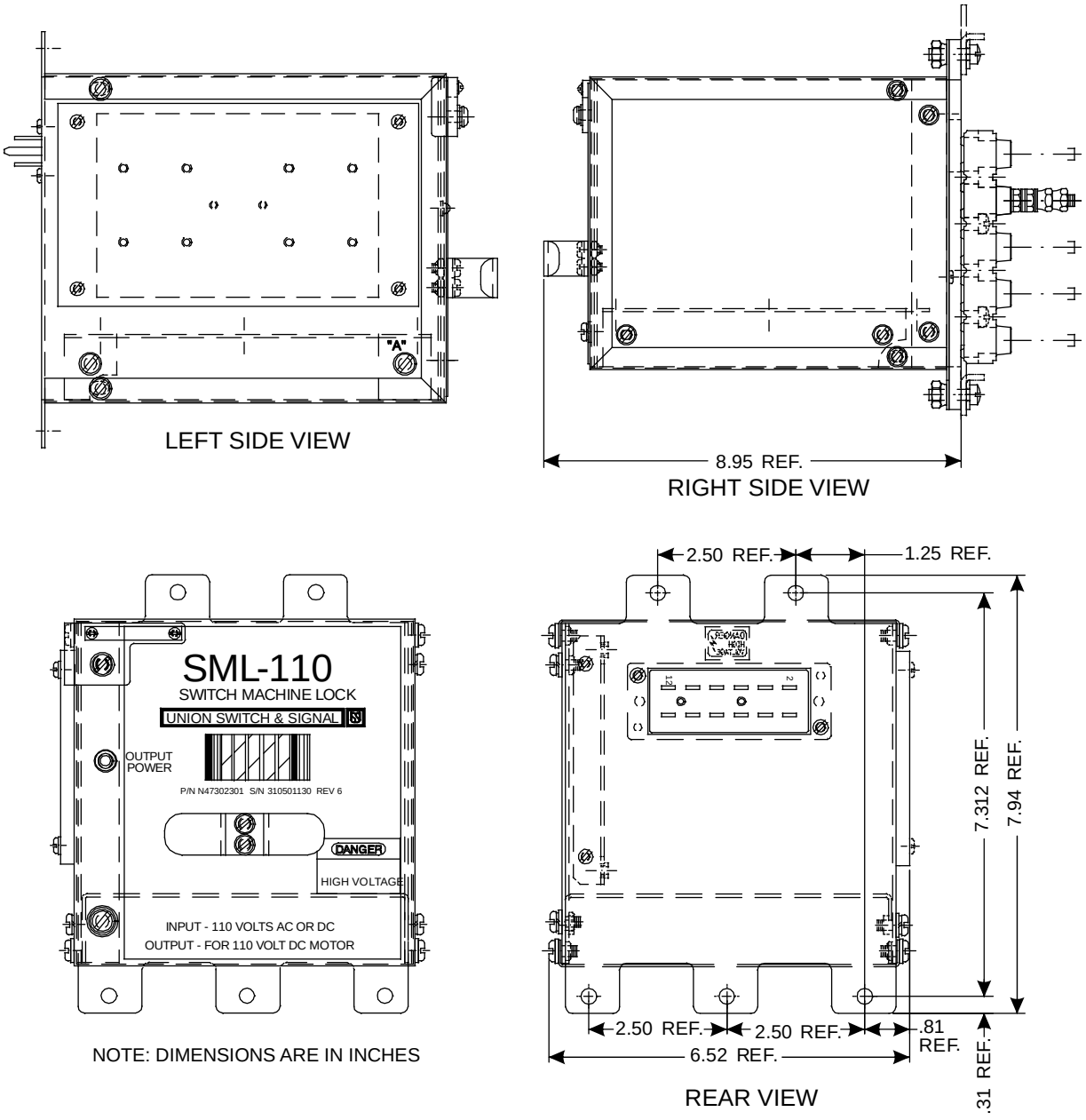


Figure 3-1 - SML-110 Installation Views

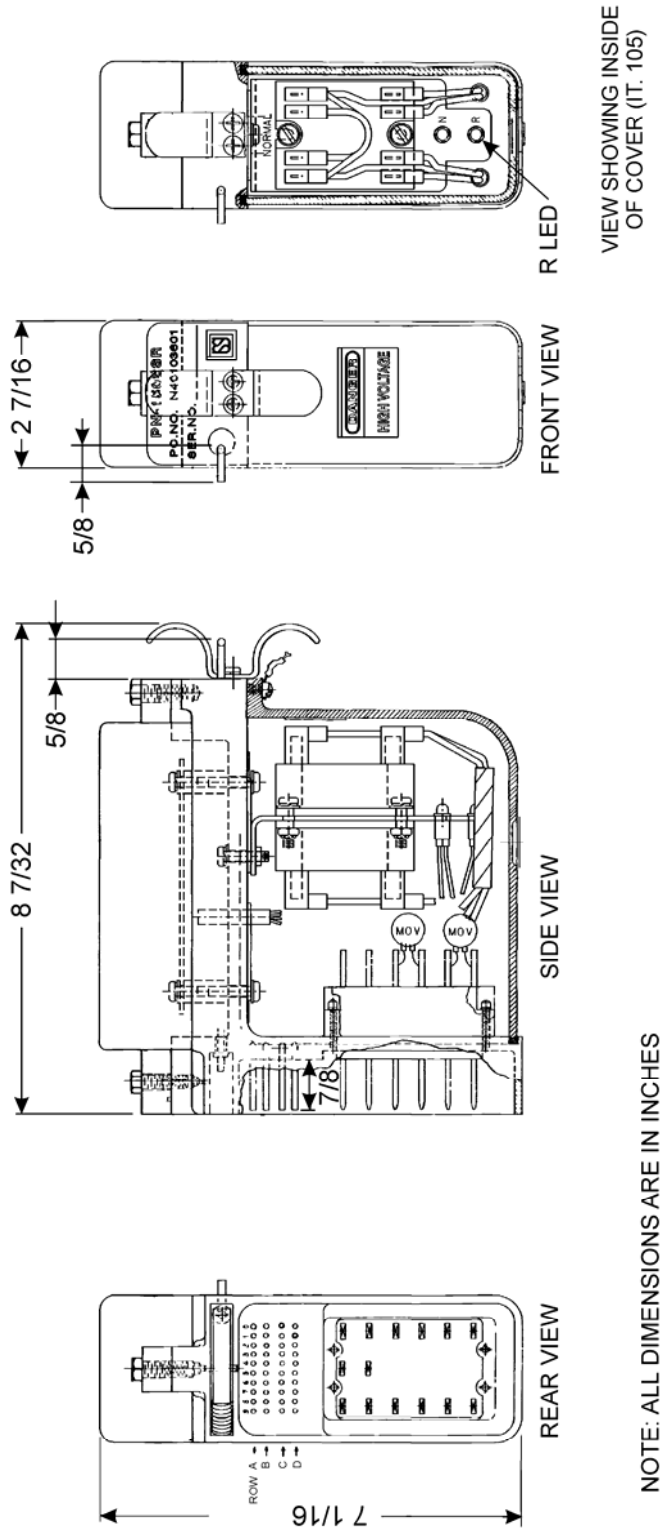
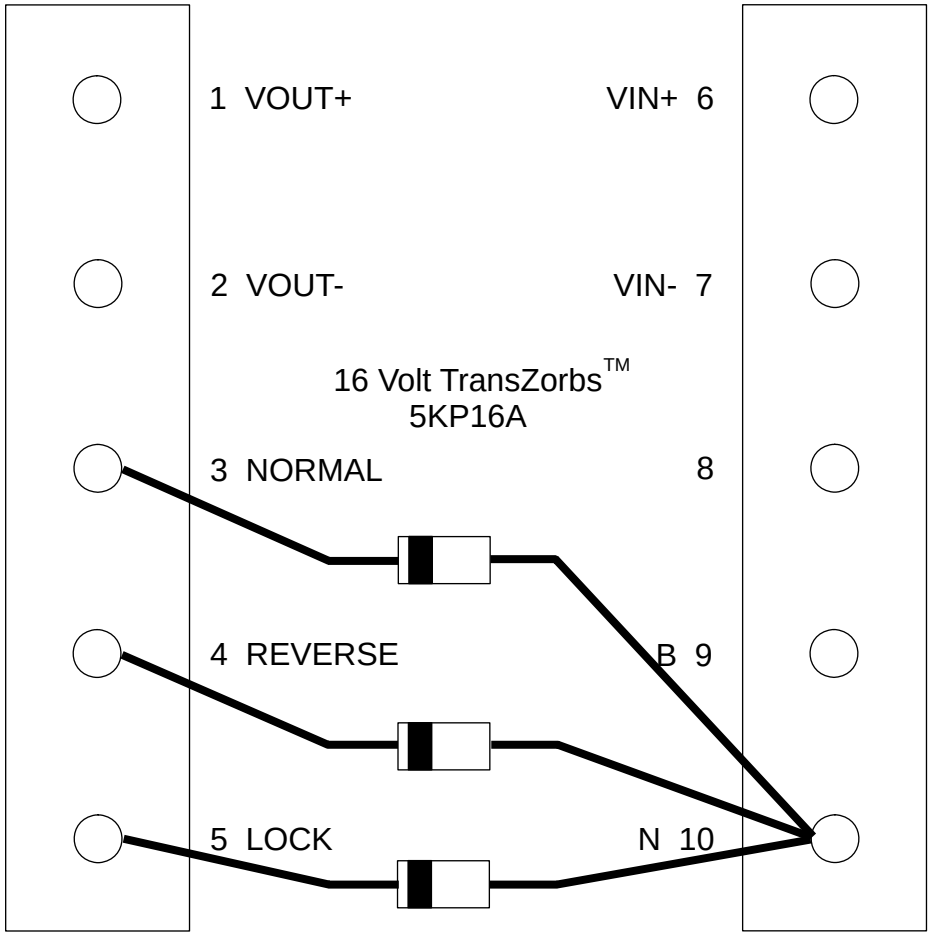


Figure 3-2 - PN-150SSR Installation Views



Rear View of SML Mounting Plate
AAR Terminals

Figure 3-3 - SML-110 Surge Protection

4 Commissioning

Commissioning is the testing process to verify proper installation before a unit or system is placed into regular service. The commissioning procedure is a functional test of the unit and the system of which it is part.

The operation of the SML-110 and PN-150SSR should be checked prior to putting the units into service, using the following procedure:

1. Apply AC or DC power, as applicable, to the SML-110. The OUTPUT POWER LED on the front of the SML-110 housing should remain off. See Figure 3-1.

2. Operate the vital control system to deliver a normal switch request to the switch machine under control. The N (normal) LED inside the PN-150SSR and OUTPUT POWER LED on the SML-110 should turn on, and the switch machine should throw to the normal position. The N LED should remain on for the switch machine operating period determined in the vital control system application logic.

3. Operate the vital control system to deliver a reverse switch request to the switch machine under control. The R (reverse) LED inside the PN-150SSR (see Figure 3-2) and OUTPUT POWER LED on the SML-110 should turn on, and the switch machine should throw to the reverse position. The R LED should remain on for the switch machine operating period determined in the vital control system application logic.

4. Place an obstruction in the switch machine, and repeat either Step 2 or 3 above. After expiration of the programmed overload timer, the vital control system should automatically remove the switch request input. In a relay interlocking, the internal timer in the SML-110 automatically turns off motor power.

5. If operating a second high-voltage switch machine, repeat Steps 2, 3, and 4 for the second machine.

6. If this operational check fails, refer to the troubleshooting information in Section 8.

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5 Operating Procedures

The SML-110 is used in conjunction with the PN-150SSR for high-voltage switch machines. Each SML-110 allows for the control of up to two switch machines simultaneously. The maximum current capacity of the SML can drive one stalled and one operating switch machine at the same time. Each PN-150SSR can control one switch machine. The PN-150SSR interfaces with two-, three-, or five-wire control switch machines and solid-state vital wayside controllers, such as the US&S Microtrax, Microlok, Microlok II, or equivalent non-US&S systems. They allow replacement of vital switch control relays, such as lock and overload.

The SML-110 uses 110 VDC or VAC and 12 VDC power sources, and 12 volt "lock, normal, and reverse" gating signals. The NW (normal) and RW (reverse) request signals are required for the PN-150SSR.

To move the switch points, NW or RW must be energized at the same time or just prior to energizing the LR/LSR signal. This completes the connections to the switch machine for the corresponding direction and energizes the motor. The logic processor in the vital controller should be programmed to cut off the LR/LSR and NW or RW output when correspondence is achieved or time has expired. In turn, the SML-110 responds to the NW, RW, or LR/LSR signal going low and turns off. A built-in 18-second timer in the SML-110 provides motor overload protection.

To de-energize the motor, the LR/LSR signal alone or both the NW and RW signals must be turned off. When driving two switch machines simultaneously, the LR/LSR signal must be turned off to de-energize either motor. This results in turning off both switch machine motors at the same time. To prevent shorting the output of the SML-110, care must be taken to avoid energizing the NW and RW signals at the same time while the LR/LSR signal is high. To properly execute a change from a normal request to a reverse request while the machine is moving, the LR/LSR and NW signals must be turned off for at least 1 second before energizing the RW and LR/LSR signals.

The 110 volt power source should not be switched on and off to control the output; it must remain on at all times.

The relay circuit in Figure 5-1 can be used to prevent the Normal and Reverse inputs from being energized at the same time.

The operational combinations of SML-110 and PN150-SSR are presented in Table 5-1.

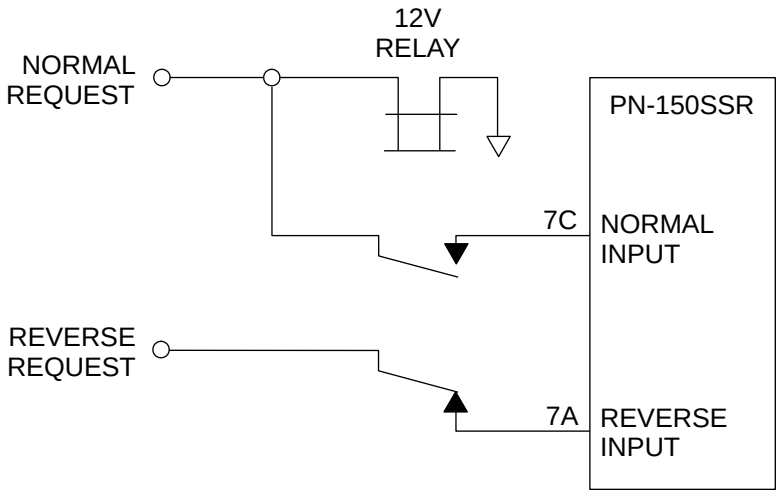

Figure 5-1 - Relay Circuit

Table 5-1 - Operation Table for SML-110 and PN-150SSR Combinations

INPUTS			OUTPUT (2-WIRE)		OUTPUT (3-WIRE)		
LOCK SML-5	**NORM SSR-7C**	**REV SSR-7A**	**SSR-10C/12A**	**SSR-10A/12C**	**CW 10C/12A**	**NW SSR-12C**	**RW SSR-10A**
0 V	0 V	0 V	OFF	OFF	OFF	OFF	OFF
12 V	12 V	0 V	+110 V	(-)	+110 V	(-)	OFF
12 V	0 V	12 V	(-)	+110 V	(-)	OFF	+110 V
0 V	12 V	0 V	OFF	OFF	OFF	OFF	OFF
0 V	0 V	12 V	OFF	OFF	OFF	OFF	OFF
0 V	12 V	12 V	OFF	OFF	OFF	OFF	OFF
*12 V	*12 V	*12 V					

*Avoid this input combination; the SSR will short the output of the SML-110.

6 Field Maintenance

6.1 Schedule

There are no Federal Railroad Administration (FRA) requirements for periodic inspection or testing of the devices covered by this manual. Periodic inspection is at the discretion of the customer.

6.2 Periodic Inspections

WARNING

Make certain all operating power sources to the units are turned off before performing any hands-on inspection; otherwise, personal injury and/or equipment damage may result.

The SML-110 and PN-150SSR should be periodically inspected in conjunction with inspections of related rack equipment. Inspection procedures are as follows:

1. Make certain both units are securely mounted to the equipment rack relay mounting bars and that all fasteners are tight.

2. Check the condition of the wiring connected to the rear AAR terminals. Make certain that all connections are tight and that no wires have been damaged or have deteriorated insulation.

3. Make certain there are no obstructions on or near the heat sink of the SML-110.

4. Make certain that the PN-150SSR is fully inserted into the relay base.

6.3 Calibration

There are no calibration procedures that can be performed in the field.

6.4 Adjustment

There are no adjustment procedures that can be performed in the field.

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7 Shop Maintenance

Switch Machine Lock SML-110 and Solid-State Relay PN-150SSR are not repairable by the user. Return a malfunctioning unit to US&S for service. Call the US&S service shop at 1-800-652-7276 for assistance.

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8 Troubleshooting

8.1 General Information

These units are not field-repairable. Field troubleshooting of these units is limited to the periodic visual inspections listed in Section 6 and isolation of faulty units as described in this section. If any unit is suspected of being faulty, make certain the problem is not caused by a fault in the associated equipment and interconnecting wiring (power sources, vital control system, switch machine, etc.). Also, check the LEDs on the respective units. Non-operational NWR and RWR LEDs on PN-150SSR may isolate the problem to the vital logic controller output board. Specific troubleshooting procedures are outlined below.

8.2 Switch Machine Lock SML-110

1. Check input power.

    a. The voltage across Terminals 6 (Vin+) and 7 (Vin-) should be between 90 VDC and 140 VDC, or between 90 VAC and 130 VAC, depending upon whether DC or AC voltage is used.

    b. The voltage across Terminals 9 (B) and 10 (N) should be between 9.8 VDC and 16.2 VDC.

2. Check the LOCK, NORMAL, and REVERSE inputs.

    a. Enable a LR/LSR signal from the relay or vital control system. The voltage across Terminals 5 (LOCK) and 10 (N) should be between 9.8 VDC and 16.2 VDC.

    b. Enable a NW signal from the relay or vital control system. The voltage across Terminals 3 (NORMAL) and 10 (N) should be between 9.8 VDC and 16.2 VDC.

    c. Enable a RW signal from the relay or vital control system. The voltage across Terminals 4 (REVERSE) and 10 (N) should be between 9.8 and 16.2 VDC.

3. Check the output to the PN-150SSR.

    a. Enable the LR/LSR and NW signals from the relay or vital control system. The voltage across Terminals 1 (Vout+) and 2 (Vout-) should be between 110 VDC and 125 VDC. The positive lead is on Terminal 1. The POWER LED should also be on.

    b. If not, there is an internal fault in the SML-110 or PN-150SSR. Unplug the PN-150SSR from the relay contact block. Repeat the test in Step a. If the voltage is correct, the problem is inside the PN-150SSR, or in the wiring to the switch machine.

    c. Enable the LR/LSR and RW signals from the relay or vital control system. The voltage across Terminals 1 (Vout+) and 2 (Vout-) should be between 110 VDC and 125 VDC. The positive lead is on terminal 1. The POWER LED should also be on.

d. If not, there is an internal fault in the SML-110 or PN-150SSR. Unplug the PN-150SSR from the relay contact block. Repeat the test in Step c. If the voltage is correct, the problem is inside the PN-150SSR, or in the wiring to the switch machine.

8.3 PN-150SSR Solid-State Relay

1. Check input power.

   a. Enable the LR/LSR and NW or RW inputs to the SML-110 from the relay or vital control system. The voltage across contacts 9C and 11A should be between 110 VDC and 125 VDC.

   b. If not, there is an internal fault in the SML-110 or PN-150SSR. Unplug the PN-150SSR from the relay contact block. Repeat the test in Step a. If the voltage is correct, the problem is inside the PN-150SSR or in the wiring to the switch machine.

2. Check the RW and NW inputs.

   a. Enable a RW signal from the relay or vital control system. The voltage across contacts 7A and 8A should be between 9.8 VDC and 16.2 VDC. The positive lead should be on contact 7A.

   b. With the RW signal still enabled, move the voltmeter's positive lead to contact 8B. The voltage should be between 9.8 VDC and 16.2 VDC. The reading should be approximately 0.6 volts less than the voltage measured in Step a.

   c. Enable a NW signal from the relay or vital control system. The voltage across contacts 7C and 8C should be between 9.8 VDC and 16.2 VDC. The positive lead should be on contact 7C.

   d. With the NW signal still enabled, move the voltmeter's positive lead to contact 7B. The voltage should be between 9.8 VDC and 16.2 VDC. The reading should be approximately 0.6 volts less than the voltage measured in Step c.

3. Check PN-150SSR's output to the switch machine.

   a. Enable the LR/LSR and NW signals from the relay or vital control system. The voltage across contacts 10C and 12C should be between 100 VDC and 125 VDC. The positive lead should be on contact 10C.

   b. Enable the LR/LSR and RW signals from the relay or vital control system. The voltage across contacts 10A and 12A should be between 100 VDC and 125 VDC. The positive lead should be on contact 10A.

9 Repairing/Replacing Components

Switch Machine Lock SML-110 and Solid-State Relay PN-150SSR are not repairable by the user.

If any of unit is suspected of being faulty, it should be returned to US&S for shop repair or complete replacement. Contact US&S for factory service procedures at:

Union Switch & Signal Inc.
Service Shop
645 Russell St.
Batesburg, SC 29006
Toll-Free: 1-800-652-7276
E-mail: railteam@switch.com

AnsaldoSTS
Union Switch & Signal

10 Parts Lists

10.1 Parts List for SML-110 Switch Machine Locks

Table 10-1 and Table 10-2 are the Parts Lists for the SML-110 Switch Machine Locks (N47302301 and N47302302). The figures associated with this table are Figure 10-1 and Figure 10-2.

Table 10-1 - Switch Machine Lock SML-110 N47302301 Parts List

Item Number	Description	Part Number
5	Cover	M47300801
10	Cover, Left Side	N47300902
15	Cover, Right Side	N47300602
20	Plate, Bottom Mounting	N47300402
25*	PCB, 110 V Switch Machine Lock	N49700501
30	Heatsink	M47302801
35	Bracket, PCB Front Mounting	N47300302
40	Bracket, PCB Rear Mounting	N47300304
50	PCB, 110 V Switch Machine FET Driver	N49700701
55	PCB, Switch Machine Rectifier	N49700801
60	Handle, Pull Aluminum	J561111
65	Plug, 12 Contact, 15 A	J071926
70	Transformer, Power	N47302001
75	Capacitor, 560 µF, 250 VDC	J7091450991
80	Clamp, Vertical Capacitor	J703124
85	LED, Red, 12 V, 15 mA	J7261500332
90	Thermal Switch, SPST SAS-85B	J705057046
95	Transistor, MOSFET STE53NC50	J7313980136
100	Resistor, 2K Ohm, 25 Watt	J7355191002
105	Screw, SS 6-32 x 3/8” Pan	J5072980106
110	Screw, SS 6-32 x 1/2” Pan	J5072980108
115	Screw, SS 6-32 x 1/2”	J5072980104
120	Washer, SS Plate No. 6	J4751200108
121	Nut, 6-32 SS Hex	J4802110103
122	Washer, SS #6 Shk Prf	J4751210126
125	Washer, SS Lock No. 6	J4751210107
130	Nut, 6-32 SS Elastic	J048102
135	Screw, SS 8-32 x 1/2” Pan	J5072950108

Item Number	Description	Part Number
140	Washer, SS Plate No. 8	J4751200109
145	Nut, 8-32 Elastic Stop SS	J048080
150	Screw, SS 10-32 x 3/8” Pan	J5072960106
155	Washer, #10 Flat	0.00305047
160	Washer, SS Lock No. 10	J4751210109
165	Screw, 4-40 x 1/4” Pan SS	J5072970104
170	Screw, SS 4-40 x 5/16” Pan	J5072970105
175	Bridge, Rectifier 400 V	J7261500349
180	Screw, 8-32 x 5/8” Pan Hd	J5072950110
185*	Wire, #20 AWG ETFE, White	A0458480071
190*	Terminal, Insul. Faston 2-520184-2	J7091461139
195*	CA-1 Twisted Pair, Shld. Mini.	A434083
200*	Tubing, Shrink Fit 1/16”	A774184
205*	Tubing, Shrink, 3/16” ID	A774169
210*	Receptacle, AMP 102104-2	J7091461068
215*	Receptacle, Housing AMP 87159-5	J7091461098
220*	Compound, Joint Thermal Cote II	J7930700001
225*	Plug, Keying Connector	J7091460514
230*	Terminal, Round, Insul., 22-18 AWG, #8	J730049
235*	Terminal, Faston Insul.	J731476
245*	Wire, #20 AWG ETFE, Orange	A0458480065
255*	Label, 0.250” x 0.900”, White	J0759550002
260*	Wire, #20 AWG ETFE, Black	A0458480058
290	Mounting Plate Assy.	N47302303
295*	Wire, #20 AWG ETFE, Blue	A0458480068
300*	Sealant, Loctite 222	A041232
305*	Wire, #20 AWG ETFE, Green	A0458480067
310*	Wire, #20 AWG ETFE, Yellow	A0458480066
315*	Wire, #14 AWG ETFE, Red	A0458480105
320*	Wire, #14 AWG ETFE, Black	A0458480061
325*	Wire, #14 AWG ETFE, Green	A0458580006
330*	Wire, #18 AWG ETFE, White	A0458480084
345*	Terminal, Pre Insul. Dia. G	J730063
350*	Terminal, Pre Insul. Dia. G	J730043
355	Plate, Heatsink	M47302701
360	Rivet 5/32” Dia. Al. Closed End	J4900370045
365	Label, Danger High Voltage	J0759550046

Item Number	Description	Part Number
370	Nut, No. 8-32 SS Hex	J4802110104
380	Screw, 10-32 x 5/16” Rd Hd SS	J5001340105
385	Washer, SS #10 Shk Prf	J4751210125
390	Label, Danger High Voltage	186-0223-00
395*	Threadlocker-242	J041245
400	Current Sense	N49700901
405	Washer, #10 Lock SS	J5001460114
410	Washer, Lock #8 SS	J4751210134
415	Kit, Tag Mounting	X47300002
998	Label, Transfer 5” Roll 7209935	A0775010003
999*	Ribbon, Thermal Transfer	A0775010007

* Not shown in Figure 10-1 and Figure 10-2.

Table 10-2 - Switch Machine Lock SML-110 N47302302 Parts List

Item Number	Description	Part Number
5	Cover	M47300801
10	Cover, Left Side	N47300902
15	Cover, Right Side	N47300602
20	Plate, Bottom Mounting	N47300402
25*	PCB, 110 V Switch Machine Lock	N49700501
30	Heatsink	M47302801
35	Bracket, PCB Front Mounting	N47300302
40	Bracket, PCB Rear Mounting	N47300304
50	PCB, 110 V Switch Machine FET Driver	N49700701
55	PCB, Switch Machine Rectifier	N49700801
60	Handle, Pull Aluminum	J561111
65	Plug, 12 Contacts, 15 A	J071926
70	Transformer, Power	N47302001
75	Capacitor, 560 µF, 250 VDC	J7091450991
80	Clamp, Vertical Capacitor	J703124
85	LED, Red, 12 V, 15 mA	J7261500332
90	Thermal Switch, SPST SAS-85B	J705057046
95	Transistor, Power MOSFET STE53NC50	J7313980136
100	Resistor, 2K Ohm, 25 Watt	J7355191002

Item Number	Description	Part Number
105	Screw, SS 6-32 x 3/8” Pan	J5072980106
110	Screw, SS 6-32 x 1/2” Pan	J5072980108
115	Screw, 6-32 x 1/4” Pan Hd SS	J5072980104
120	Washer, SS Plate No. 6	J4751200108
121	Washer, SS #6 Shk Prf	J4751210126
122	Nut, 6-32 SS Hex	J4802110103
125	Washer, SS Lock No. 6	J4751210107
130	Nut, 6-32 SS Elastic Stop	J048102
135	Screw, SS 8-32 x 1/2” Pan	J5072950108
140	Washer, SS Plate No. 8	J4751200109
145	Nut, 8-32 Elastic Stop SS	J048080
150	Screw, SS 10-32 x 3/8” Pan	J5072960106
155	Washer, #10 Flat	0.00305047
160	Washer, SS Lock No. 10	J4751210109
165	Screw, 4-40 x 1/4” Pan SS	J5072970104
170	Screw, SS 4-40 x 5/16” Pan	J5072970105
175	Bridge, Rectifier 400 V	J7261500349
180	Screw, 8-32 x 5/8” Pan Hd	J5072950110
185*	Wire, #20 AWG ETFE, White	A0458480071
190*	Terminal, Insul. Faston 2-520184-2	J7091461139
195*	CA-1 Twisted Pair, Shld. Mini.	A434083
200*	Tubing, Shrink Fit 1/16”	A774184
205*	Tubing, Heat Shrink 3/16” ID	A774169
210*	Receptacle, AMP 102104-2	J7091461068
215*	Receptacle, Housing AMP 87159-5	J7091461098
220*	Compound, Joint Thermal Cote II	J7930700001
225*	Plug, Keying Connector	J7091460514
230*	Terminal, Round, Insul., 22-18 AWG, #8	J730049
235*	Terminal, Faston Insul.	J731476
245*	Wire, #20 AWG ETFE, Orange	A0458480065
255*	Label, 0.250” x 0.900”, White	J0759550002
260*	Wire, #20 AWG ETFE, Black	A0458480058
295*	Wire, #20 AWG ETFE, Blue	A0458480068
300*	Sealant, Loctite 222	A041232
305*	Wire, #20 AWG ETFE, Green	A0458480067
310*	Wire, #20 AWG ETFE, Yellow	A0458480066
315*	Wire, #14 AWG ETFE, Red	A0458480105

Item Number	Description	Part Number
320*	Wire, #14 AWG ETFE, Black	A0458480061
325*	Wire, #14 AWG ETFE, Green	A0458580006
330*	Wire, #18 AWG ETFE, White	A0458480084
345*	Terminal, Pre Insul. Dia. G	J730063
350*	Terminal, Pre Insul. Dia. G	J730043
355	Plate, Heatsink	M47302701
360	Rivet, 5/32” Dia. Al. Closed End	J4900370045
365	Label, Danger High Voltage	J0759550046
370	Nut, 8-32 SS Hex	J4802110104
380	Screw, 10-32 x 5/16” Rd Hd SS	J5001340105
385	Washer, SS #10 Shk Prf	J4751210125
390	Label, Danger High Voltage	186-0223-00
395*	Threadlocker-242	J041245
400	Current Sense	N49700901
405	Washer, #10 Lock SS	J5001460114
410	Washer, Lock #8 SS	J4751210134
415	Kit, Tag Mounting	X47300002
998	Label, Transfer 5” Roll 7209935	A0775010003
999*	Ribbon, Thermal Transfer	A0775010007

* Not shown in Figure 10-1 and Figure 10-2.

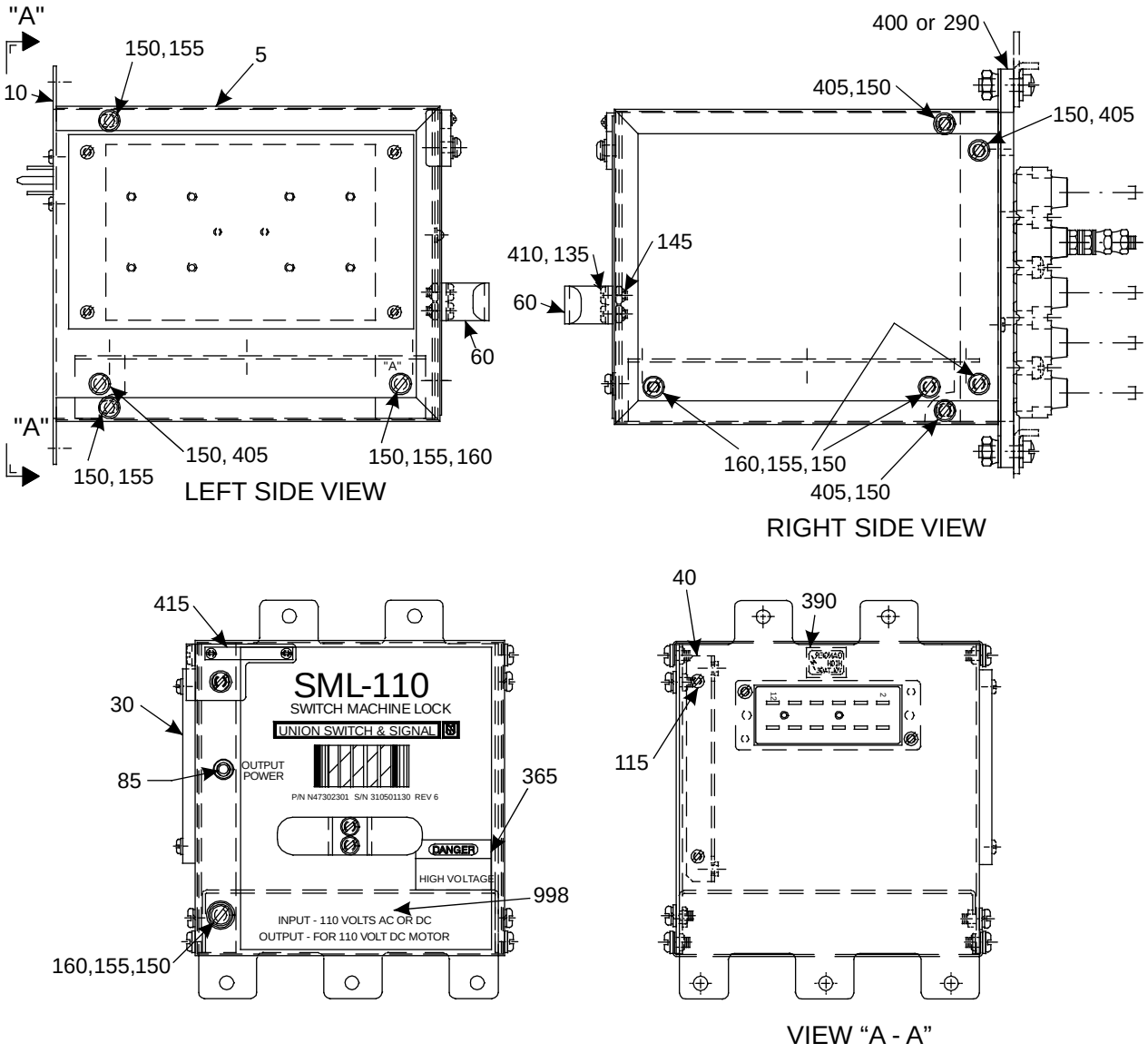

Figure 10-1 - Parts Location for SML-110 Switch Machine Locks (N47302301 and N47302302)

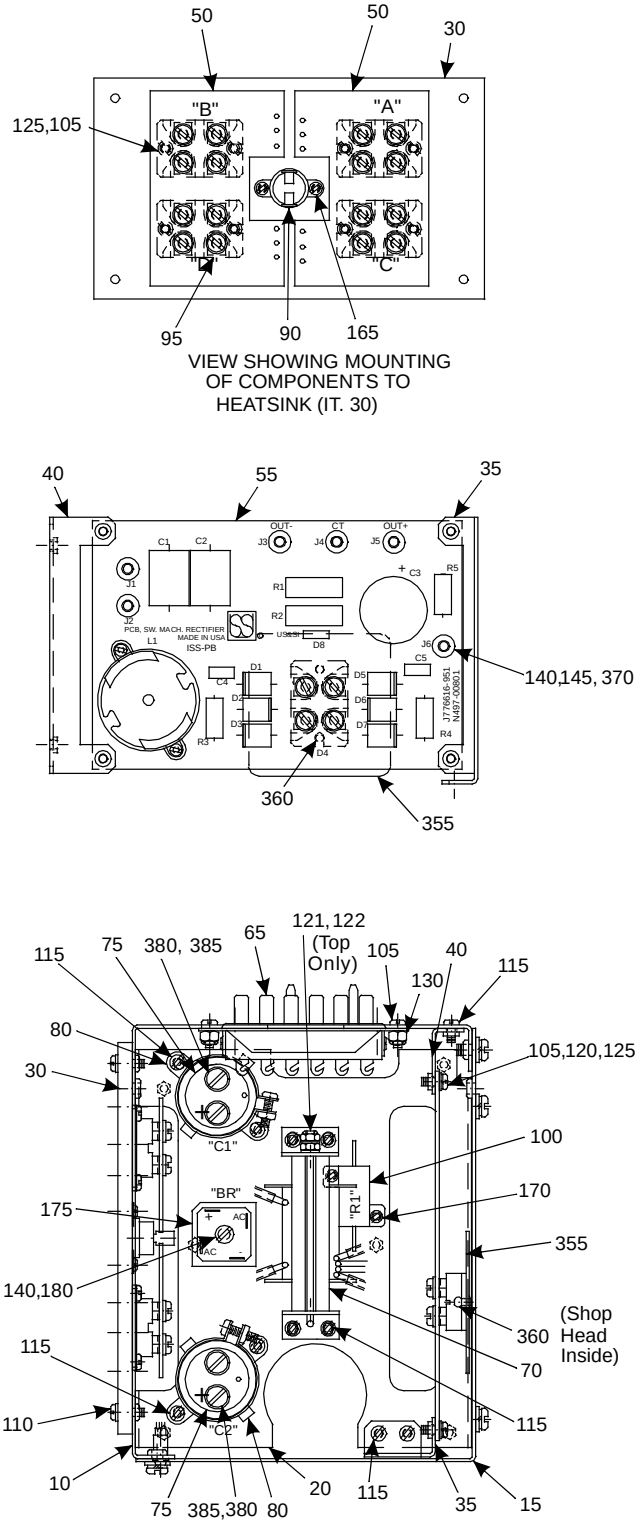

Figure 10-2 - Parts Location for SML-110 Switch Machine Locks (N47302301 and N47302302)

10.2 Parts List for Solid-State Relay PN-150SSR (N40103601)

Table 10-3 is the Parts List for the Solid-State Relay PN-150SSR (N40103601). The figure associated with this table is Figure 10-3.

NOTE

The part number of the standard base for the Solid-State Relay PN-150SSR is N4513760302. This base includes 20 contact springs for 14-16 gauge wire. In certain high-voltage/current applications, an optional relay base (N4513760305) is used. This base includes contact springs for number 10 wire.

Table 10-3 - Solid-State Relay PN-150SSR N40103601 Parts List

Item Number	Description	Part Number
5	Frame, Relay	M40103801
10	Latch, Rod	M388888
15	Latch, Machined	M321728
20	Pin, Roll SS	J048716
25	Spring, Plated	M321861
30	Block, Contact	N40103901
35	Screw, SS 6-32 x 3/4” Fil Hd	J5072980120
40	Washer, SS Lock No. 6	J4751210107
45	Washer, SS.170” ID Flat	J4751210127
50	Screw, 8-32 x 3/4” Pan Hd	J5072950112
55	Washer, SS Plate No. 8	J4751200109
60	Washer, SS Lock No. 8	J4751210108
65*	Spacer, Standoff 1/4”	J585853
70	PCB, Solid-State Relay	N40104101
75	Bracket, Relay Mounting	N40104002
80	Handle, Pull Aluminum	J561111
85	Washer, SS #10 Shk Prf	J4751210125
90	Screw, SS 10-32 x 3/8” Ph	J5072960129
95	Rivet, Dual SS H12D4840D	J7261530322
100	Nut, 8-32 Elastic Stop SS	J048080
105	Cover, Molded Relay	J776596
110	Gasket, Rubber	J047081
115	Seal, Adhesive Ventil.	J790257
120	Cover, Molded	N437490
125	Screw, 1/4-20 x 3/4” Hex Hd SS	J5000970112
130	Pin, Roll 3/32” D x 1-1/8”	J487090

Item Number	Description	Part Number
135*	Screw, 8-32 x 7/16” L, Fil Hd	J5072950119
140*	Wire Seal, #22 AWG, 2 Ply	A043013
145*	Seal, Security, Gray	J079351
150	LED, Red, 12 V, 15 mA	J7261500332
155	Tubing, Spiral Wrap, 1/4” O.D.	A774241
160*	Wire, #14 AWG ETFE, Black	A0458480061
165*	Terminal, Female Right Angle, Red	J7313990054
170*	Terminal, Receptacle Faston	J7314830008
175*	Sealant, Loctite 271	J041794
180*	Wire, #20 AWG ETFE, Yellow	A0458480066
185	Nameplate, SSR	M40104301
190	Label, Danger High Voltage	J0759550046
195*	Bag, Plastic, #60F-0406	J078399
210	Wire, #20 AWG ETFE, Blue	A0458480068
215*	Wire, #20 AWG ETFE, Green	A0458480067
220*	Wire, #20 AWG ETFE, Violet	A0458480069
225	Screw, SS 8-32 x 3/8” Pan	J5072950106
230*	Tubing, Insul. 1/4” Dia.	A578567
235*	Terminal, Female Faston .187” Blue	J7313990154
240	Varistor V230L40C	J7355500018
244*	Bag, Parts	N3306814036

* Not shown in Figure 10-3.

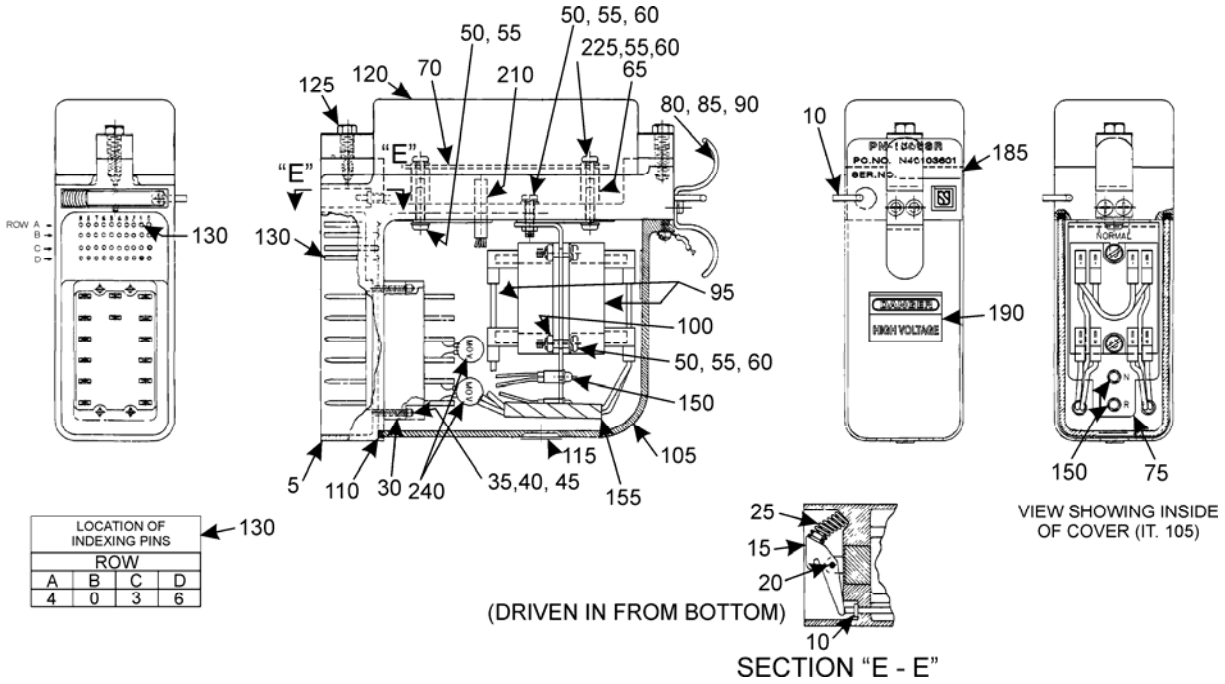

Figure 10-3 - Parts Location for Solid-State Relay PN-150SSR (N40103601)

11 Technical Support

The Rapid Action Information Link Team (RAIL Team) is a group of experienced product and application engineers ready to assist you to resolve any technical issues concerning this product. Contact the RAIL Team at 1-800-652-7276 or by e-mail at railteam@switch.com.

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